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Agricultural Policy Review

Volume 2019 | Issue 3 Article 5

Fall 2019

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IF YOU follow news around the Renewable Fuel Standard (RFS), you have probably heard about small refinery exemptions (SREs) and E15. E15 is a small market—just over half of one percent of gas stations in the United States sell the fuel (RFA 2019). Meanwhile, SREs reduced the total RFS mandates by over four billion gallons from 2016 to 2018 (Irwin 2019). In this article, I argue that the battle over E15 is intricately related to SREs beyond the 'great compromise' the Trump administration is selling to the ethanol and oil industries.

Ethanol demand: A brief history

The original RFS essentially guaranteed the conventional ethanol industry a 15 billion gallon per year market beginning in 2015. Almost five years past this mark, the industry has yet to realize that level of ethanol demand. Among the problems contributing to this are rigidities in types of ethanol-blended fuels that retailers can sell and, absent substantial price discounts, lackluster demand for high-blend ethanol fuels.

Before this summer, the US Clean Air Act effectively dictated that ethanol be sold to US consumers in two blends: E10 (10% ethanol) and E85 (51–85% ethanol blends). However, to use E85, consumers need to own flex-fuel vehicles (FFVs) and gasoline stations need specialized fueling infrastructure. For a variety of reasons, the market never really took off, and the primary way firms complied with the RFS until 2013 was through converting gasoline from E0 (no ethanol) to E10 nationwide. Figure 1 compares monthly ethanol production, adjusted for imports and exports, to ethanol demand under a national 10% ethanol blend.[1]

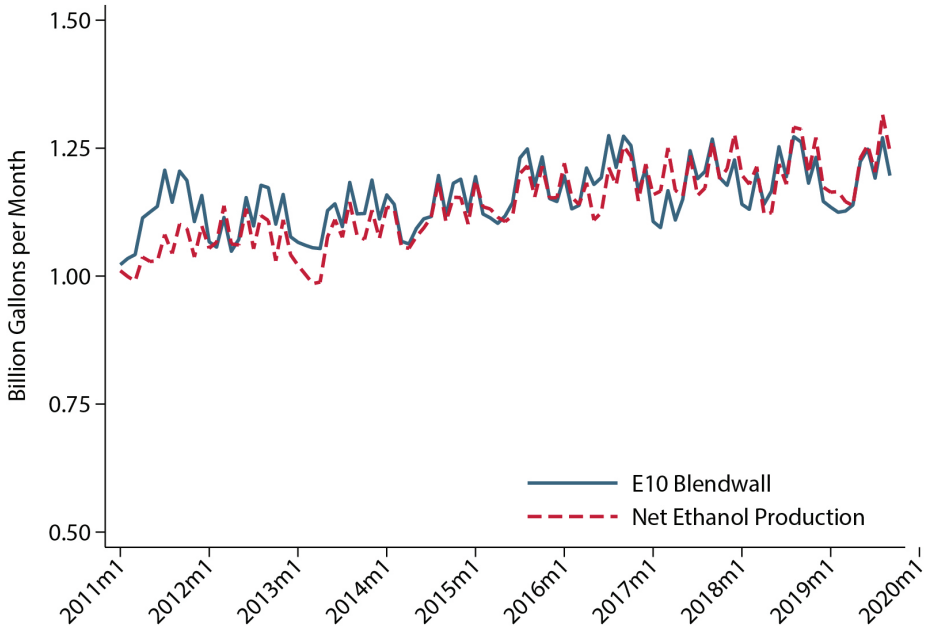

Figure 1: US ethanol production and the blend wall.
Source: US Energy Information Administration and author's calculations.

The E0-to-E10 strategy faced a serious problem beginning in 2013/14. In 2013, net monthly ethanol production averaged 1.06 billion gallons (bgals) per month, while the most ethanol that could be blended as E10 was 1.11 bgals. Ethanol production and E10 demand converged in 2014 at 1.11 bgals and 1.12 bgals per month, respectively. Since 2014, the annual potential for ethanol in E10 has fluctuated between about 14 bgals and 14.2 bgals. While we have seen some months where ethanol production exceeded the E10 blend wall, it has never been more than 15 million gallons above the blend wall in any given month, highlighting the limited sales of high-blend ethanol fuels to date.

Pouliot and Babcock (2015) argue that E85 could bridge the roughly 800-million-gallon gap between the blend wall and the 15 bgal conventional mandate. Realities on the ground show that: (*a*) at current prices consumers are not willing to buy that much E85; (*b*) the EPA is unwilling to allow compliance credit prices to increase to the level needed to spur consumer demand for E85; and, (*c*) the market for E85 vehicles is declining given the phase-out of government subsidies for their production (Lade 2018). This leaves the ethanol industry in a bit of a bind. In the absence of large-scale E85

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[1] I construct my measure of net ethanol production using data from the Energy Information Administration on monthly US ethanol production plus imports minus exports. The blend wall estimate is monthly product supplied for finished gasoline reported by the EIA multiplied by 0.10. The measures are admittedly crude, and alternative measures of domestic ethanol use would show slightly different results.

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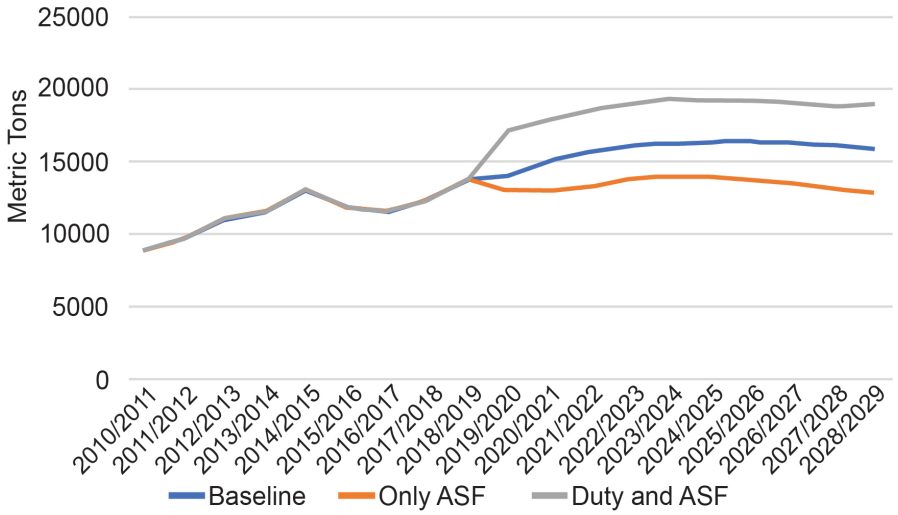

Figure 4. US soybean meal exports (Metric tons).

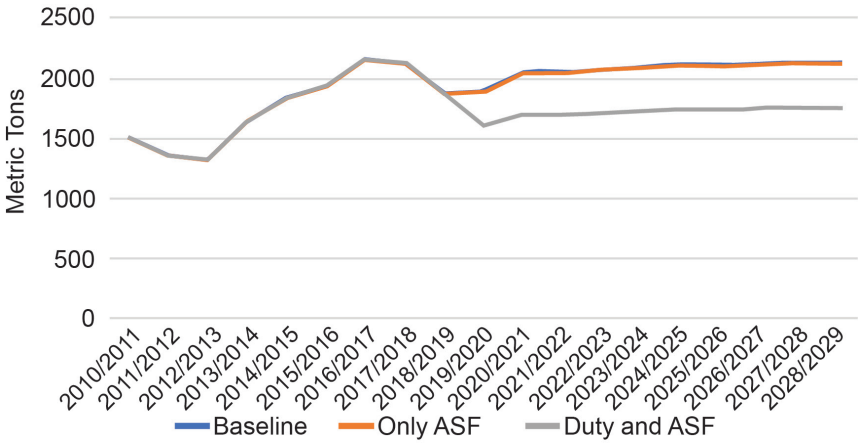

Figure 5. US soybean exports (Metric tons).

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adoption, refiners have complied with RFS mandates exceeding the blend wall by taking advantage of flexibility in the program and purchasing compliance credits generated through increased biodiesel blending.

E15 demand: A new way to break the blend wall?

The ethanol industry seems to have shifted focus from E85 to expanding the market for E15 (fuel containing 15% ethanol).[2] Why would the industry lobby so hard to expand market access of a lower-blend fuel? Because the vehicle market is far greater for E15. In 2011, EPA granted a partial waiver to E15, approving its use in any model-year vehicle 2001 or newer (EPA 2011). Where FFVs make up around 7% of the passenger vehicle market, E15 can be used in more than 90% vehicles. However, the industry faced another obstacle: most retailers were not allowed to sell E15 in the summertime. Station owners are unlikely to invest in infrastructure for products that they cannot sell half the year. However, this changed in March 2019 when EPA finalized actions to allow year-round E15 sales (EPA 2019a).

Small refiner waivers and E15 demand

The ethanol industry now has a new means to break the blend wall. Even modest E15 adoption could substantially expand domestic ethanol demand, eroding refiners' market share. The success of E15, however, depends crucially on consumers' willingness to pay for the new product. Most consumers know that ethanol has lower energy content than gasoline, thus E15 needs to be around 1.7% cheaper than E10 to make up for the lost fuel mileage. However, we know that E85 consumers use rules of thumb (Lia, Pouliot, and Babcock 2018), and often do not purchase E85 in large quantities unless the discount is well below energy parity. Further, consumers face conflicting information about E15 (Edmunds 2013). All of this likely increases the discount needed for large-scale E15 adoption.

E15 price data is relatively scarce. To explore where prices stand, I constructed my own estimates of retail E15 and E10 prices since 2018 using data from the Chicago Mercantile Exchange and assuming typical mark-ups and taxes for Minnesota. The top panel of figure 2 presents my estimated E15 prices and compares them to monthly E15 prices reported by the Minnesota Department of Commerce. The bottom panel shows the E15 price discount relative to E10.[3] The top figure confirms that my constructed estimates follow closely to actual retail prices. The bottom panel shows the E15 price discount is small and has not exceeded 1.5% since 2018. The discounts are not large enough to spur substantial E15 sales.

Now we come to the crux of my argument. At least in the short run, spurring large-scale E15 demand will require noticeably lower prices than E10. Given market prices over the last two years, the only way to realize these large E15 discounts is by increasing the implicit RFS subsidy for ethanol. Enter small refinery waivers. The EPA has vastly increased the use of SRE provisions since 2017 (EPA 2019b). SREs have lowered compliance credit prices, decreasing the RFS subsidy for ethanol and limiting the discount retailers can offer for E15. So long

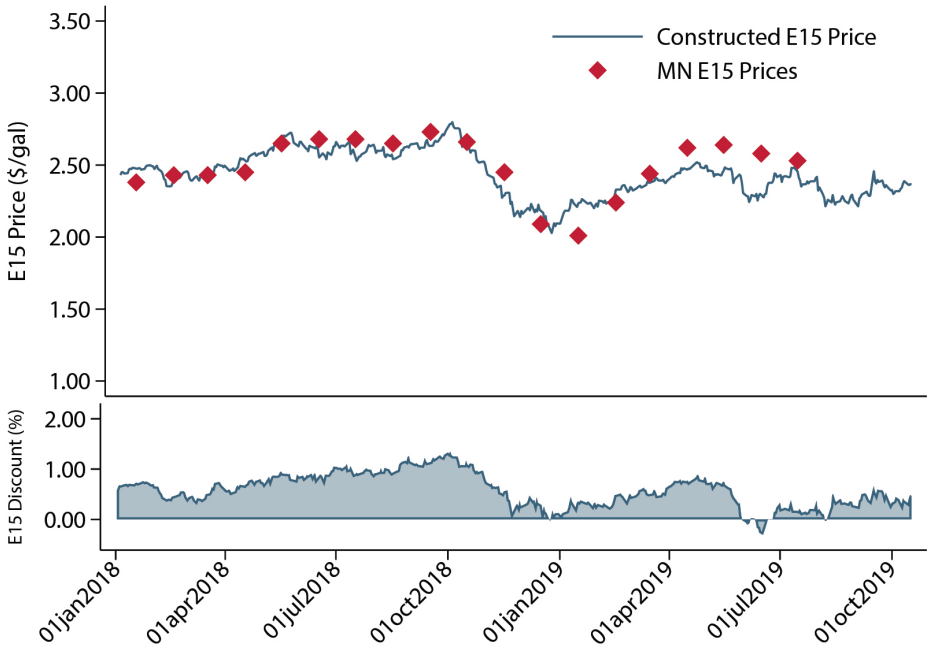

Figure 2. Constructed and actual Minnesota E15 prices.
Sources: Chicago Mercantile Exchange, MN Department of Commerce, and author's calculations.

[2] This is not to say the industry does not still promote E85.

[3] Specifically, I use ethanol and RBOB gasoline price data from CME and calculate a weighted average E10 and E15 price series assuming each contains 10% and 15% ethanol, respectively. I assume each price is marked up by a $0.015 /gallon transportation cost, a $.27 /gallon retail markup, and a $0.4919/gallon sales tax. Estimates do not include RIN prices. The choice is intentional to illustrate the potential E15 price discount as a stand-alone product with no RFS support.

as SREs remain commonplace, as EPA indicated they would (EPA 2019c), E15 price discounts will be low, limiting the current and future potential for the E15 market.

The battle for market share in a declining market

If projections are correct, the liquid transportation fuel market is in decline. The Department of Energy anticipates gasoline use will decline from 137 bgals per year to around 110 bgals by 2030. How much of that market will be gasoline versus ethanol depends on what fuels are available to consumers and the level, or lack thereof, of government support for biofuels. Assuming support for conventional ethanol eventually phases out, E10 and E15 will need to stand on their own. As we see in figure 1, E15 is just not cheap enough to spur large-scale consumer adoption. If, however, SREs are removed and ethanol subsidies under the RFS increase to historical levels, we may see some consumers begin to use E15 regularly. Over time, as the fuel becomes less of a novelty, the E15 market could expand, eroding gasoline's market share. This is not a situation the fossil fuel industry wants to see. Thus, the battle over SREs can be cast as a battle over long-term market shares, where one side wants to ensure this new product market remains small, and the other wants to see it expand.

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